$AF/1740

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	10/796,836
Applicant:	:	Kuthi et al.
Filed:	:	08 March 2004
Title:	:	SEMICONDUCTOR PROCESS CHAMBER ELECTRODE
TC/A.U.	:	1763
Examiner	:	Alejandro Mulero, L.
Atty. Docket No.	:	LAM1P077A2
Date:	:	August 22, 2005

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on **August 22, 2005.**

Signed: [signature]
Lauren Leschauer

TRANSMITTAL OF APPEAL BRIEF (PATENT APPLICATION -- 37 CFR 192)

Commissioner for Patents
Mail Stop: Appeal Brief- Patents
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is in furtherance of the Notice of Appeal filed in this case on June 17, 2005. The Notice of Appeal was received by the USPTO on June 21, 2005.

This application is on behalf of:

☐ Small Entity ☒ Large Entity

Pursuant to 37 CFR 1.17(f), the fee for filing the Appeal Brief is:

☐ \$250.00 (Small Entity) ☒ \$500.00 (Large Entity)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136 apply:

☐ Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

Months	Large Entity	Small Entity
☐ one	$120.00	$60.00
☐ two	$450.00	$225.00
☐ three	$1,020.00	$510.00

☒ If an additional extension of time is required, please consider this a petition therefor.

☐ An extension for __ months has already been secured and the fee paid therefor of $_____ is deducted from the total fee due for the total months of extension now requested.

☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Total Fees Due:

Notice of Appeal Fee	$500.00
Extension Fee (if any)	$
Total Fee Due	**$500.00**

☒ Enclosed is Check No. 14764 in the amount of $500.00.

☒ Charge any additional fees or credit any overpayment to Deposit Account No. 50-0850, (Order No. LAM1P077A2).

Respectfully submitted,
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

EX PARTE KUTHI, ET AL.

Application for Patent

Filed March 8, 2004

Application No. 10/796,836

FOR:

SEMICONDUCTOR PROCESS CHAMBER ELECTRODE

APPEAL BRIEF

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop Appeal, Commissioner for Patents, P.O. Box 1450, Alexandria, VA, 22313-1450, on August 22, 2005

Signed: Lauren Leschauer
Lauren Leschauer

MARTINE PENILLA & GENCARELLA, LLP
Attorneys for Applicants

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I. REAL PARTY IN INTEREST

The real party in interest is Lam Research Corporation, the assignee of the present application.

II. RELATED APPEALS AND INTERFERENCES

The present application is a Continuation application of prior application, U.S. Patent Application Serial No. 09/611,037. A Notice of Appeal was filed in prior application 09/611,037 on November 29, 2004. An Appeal Brief was filed in prior application 09/611,037 on March 3, 2005. In response to the Appeal Brief, prosecution was re-opened in prior application 09/611,037, and a non-final Office Action was mailed on May 13, 2005.

III. STATUS OF THE CLAIMS

A total of 14 claims were presented during the prosecution of the present application. Applicant appeals the final rejection of claims 1-14.

IV. STATUS OF THE AMENDMENTS

No Amendment has been filed subsequent to Final Rejection.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

In one embodiment of the invention, Applicants claim an apparatus. The apparatus includes an electrode capable of being positioned over a substrate location (page 6, lines 8-22, page 11, line 11 – page 12, line 16, Figs. 2A, 2B, 2C, 2D, 2E). The electrode has a center region, a first surface and a second surface (page 6, lines 8-22). The first surface is configured to receive processing gases and to enable flow of the processing gases through the center region. The second surface has a plurality of gas feed holes (228, Figs. 2A, 2E) that are coupled to a corresponding plurality of electrode openings (202b, Figs. 2A, 2B, 2C, 2D, 2E) that have electrode opening diameters (242, Figs. 2C, 2D) that are greater than gas feed hole diameters (240, Figs. 2C, 2D) of the plurality of gas feed holes (228). The plurality of electrode openings (202b) are configured to define the second surface which is located over the substrate

(236, Fig. 2E) location. The second surface has a surface area that is larger than a surface area of the substrate location (page 13, lines 1-13, page 14, lines 1-20, Table A). The larger surface area is capable of inducing an increased bias voltage at a point closer to the substrate location, and a decreased bias voltage at a point closer to the second surface of the electrode when a plasma is struck in a space defined between the second surface and the substrate location (page 15, line 7 – page 17, line 15, Figs. 4A, 4B, 5).

In another embodiment of the invention, Applicants claim an electrode (page 6, lines 8-22, page 11, line 11 – page 12, line 16, Figs. 2A, 2B, 2C, 2D, 2E). The electrode includes an electrode body that has a first surface and a second surface (Fig. 2A). The second surface has a plurality of gas feed holes (228, Figs. 2A, 2E) that are coupled to a corresponding plurality of electrode openings (202b, Figs. 2A, 2B, 2C, 2D, 2E). Each electrode opening has an electrode opening diameter (242, Figs. 2C, 2D) that is greater than a gas feed hole diameter (240, Figs. 2C, 2D) of each of the plurality of gas feed holes (228). The second surface is defined by inner surfaces of the plurality of electrode openings (202b) so that a surface area of the second surface is larger than a surface area of the electrode body without the plurality of electrode openings (page 13, lines 1-13, page 14, lines 1-20, Table A, Fig. 1C). The larger second surface area is capable of inducing an increased bias voltage at a substrate processing surface (page 15, line 7 – page 17, line 15, Figs. 4A, 4B, 5).

In a further embodiment, Applicants claim an electrode (page 6, lines 8-22, page 11, line 11 – page 12, line 16, Figs. 2A, 2B, 2C, 2D, 2E). The electrode includes an electrode body which includes a first surface and a second surface (Fig. 2A). The second surface has a plurality of gas feed holes (228, Figs. 2A, 2E). Each one of the plurality of gas feed holes is integrally coupled to a corresponding electrode opening

to comprise a plurality of electrode openings (202b, Figs. 2A, 2B, 2C, 2D, 2E). Each one of the plurality of electrode openings (202b) is larger than each one of the plurality of gas feed holes (228). The second surface defines a boundary of a plasma sheath (Fig. 2E). The plasma sheath has a first plasma sheath surface and a second plasma sheath surface (Fig. 3). The second plasma sheath surface is at least partially within the plurality of electrode openings (Fig. 2E, Fig. 3).

In still a further embodiment, Applicants claim an electrode (page 6, lines 8-22, page 11, line 11 – page 12, line 16, Figs. 2A, 2B, 2C, 2D, 2E). The electrode includes an electrode body that has a process surface (Fig. 2A). The process surface has a plurality of gas feed holes (228, Figs. 2A, 2E). Each gas feed hole is integrally coupled to a corresponding electrode opening (202b, Figs. 2A, 2B, 2C, 2D, 2E). The electrode opening (202b) is larger than the gas feed hole (228). The process surface defines a plasma sheath having a surface that is at least partially within each electrode opening (Fig. 2E, Fig. 3).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds for rejection to reviewed on appeal are as follows:

Claims 1-14 were finally rejected under 35 USC §103(a).

VII. ARGUMENT

A. Claims 1-14 are not rendered obvious by Tomita et al. in view of Chang et al.

Claims 1-14 stand rejected under 35 USC §103(a) as being unpatentable over Tomita et al. (U.S. Patent No. 5,593,540) in view of Chang et al. (U.S. Patent No. 4,854,263).

Tomita et al. disclose a plasma etching system including a process chamber for enclosing a plasma, and a means for evacuation of the plasma from the chamber. A substrate is supported on a chuck electrode, and a shower electrode is positioned

facing the chuck electrode. The shower electrode has a plurality of small holes. A power source is provided to strike a plasma between the chuck electrode and the shower electrode. Plasma forming gases are supplied through the small holes into the space between the chuck electrode and the shower electrode. The gas is supplied through the small holes at a mass flow rate of at least 620 $kg/m^2/hr$.

Chang et al. describe a gas manifold that can act as an electrode used in a plasma-enhanced chemical vapor deposition system (PECVD). Essentially, Chang et al. teach chemical vapor deposition onto a substrate, and the stated objects are providing a gas manifold designed to increase the dissociation and reactivity of gases such as nitrogen, providing an improved parallel plate and gas inlet manifold configuration for forming low hydrogen content silicon nitride films at high deposition rates using nitrogen with reduced ammonia or without ammonia. Chang et al. also state that an objective of the invention is to provide an improved parallel plate electrode and gas inlet manifold configuration for forming silicon oxide films and for forming low hydrogen content silicon oxynitride films at high deposition rate using nitrogen with reduced ammonia or without ammonia.

In rejecting claims 1-14, the Examiner has asserted that the combination of references is proper, even though Applicants have submitted that the proposed modification of the Tomita et al. apparatus would render the Tomita et al. apparatus unsatisfactory for its intended purpose, since Applicants' asserted reasoning, apparently, is attacking the references individually. Applicant respectfully submits that the Examiner has misinterpreted or misapplied the standards of *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Applicants respectfully submit that the correct inquiry in the present application is whether there is suggestion or motivation to make the proposed modification. Applicants respectfully submit that there is no suggestion or motivation in accordance with the correct standard of *In re Gordon*, 733 F2d 900, 221 USPQ 1125 (Fed. Cir. 1984) as reproduced at MPEP §2143.01:

> If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

Applicants respectfully submit, and further support in the attached Declaration, the Tomita et al. apparatus is constructed in such a manner as to prevent plasma flow into the electrode openings. Tomita et al. therefore teach away from any possibility of such plasma flow. As illustrated in Figure 4 of Tomita et al. (shown

below), and described at col. 5, lines 14-20, the Tomita et al. apparatus includes a small hole 55b formed in the cathode plate 54 which is smaller than a small hole 55a formed in the cooling plate 53. Gas flowing through the small hole 55 as taught by Tomita et al. effectively prevents the plasma formed between the chuck electrode and the shower electrode from flowing back up into the small hole 55, or shifting into the small hole 55. Further, as described in detail in Applicants' Declaration, such plasma flow is ***undesirable*** in an apparatus as disclosed by Tomita et al. The object of the Tomita et al. apparatus is to suppress and prevent polymer build-up in the gas flow holes (55), and the structural design with the small hole 55b formed in the cathode plate 54 being smaller than the small hole 55a formed in the cooling plate 53, in combination with the disclosed mass flow rate achieves the desired objective. If, however, the geometry of the openings is modified as asserted by the Examiner, the objective would be unattainable, and the apparatus would be rendered unsatisfactory for its intended purpose. As set forth in Applicants' Declaration, the claimed structure and resulting function of the present invention is antithetical to the stated design goals of Tomita et al.

Tomita et al. disclose an apparatus and structure to ***prevent or suppress*** plasma from flowing into the small holes 55b. As stated at col. 2, lines 46-52, "The particular gas supply system employed in the present invention permits suppressing the plasma polymerization within the small holes, with the result that a polymer is unlikely to be deposited on the circumferential wall of the small hole. Even if a polymer is formed, the polymer is blown away by the gas stream flowing at a high speed." If the asserted combination would allow plasma flow into the small holes, or shift the plasma sheath into the gas feed holes, then the polymerization formation sought to be prevented and overcome would be created. Similarly, in a re-formed electrode and gas feed hole structure as proposed by the combination of Tomita et al. and Chang et al., a primary principle of operation of the Tomita et al. structure is not only modified, but defeated. Although the Examiner asserts that such a combination would be obvious to enhance dissociation and reactivity of the gases, the assertion is incorrect. To modify the apparatus in such a manner would not only modify the principle of operation of the apparatus, but it would ***defeat*** the principle of operation.

As stated in the submitted Declaration at paragraph 2,

> The reference patent teaches how to prevent polymer deposition in the small holes of a showerhead electrode by high speed of gas flow. To

achieve a mass flow speed of at least 620 kg/m^2/hr, the reference specifies the diameter of the holes in the showerhead must be smaller than 0.6 mm. The reference specifies 0.6 mm as the maximum diameter of the hole. Any hole larger than 0.6 mm will reduce gas speed and cannot prevent polymer deposition.

The proposed modification of the Tomita et al. electrode would essentially result in the exact opposite of the structure as taught by Tomita et al. and illustrated in Fig. 4 of the reference (see below), *i.e.*, a gas feed hole that is *smaller* than the electrode opening. In order to achieve and maintain the high speed gas flow taught by Tomita et al., the disclosed and illustrated structure must be maintained. Tomita et al. address gas dissociation and reactivity by use of buffer plates (as pointed out by the Examiner) and baffle plate 50. The asserted modification could not achieve and maintain the high speed gas flow, and therefore the asserted modification and combination would render the prior art unsatisfactory for its intended purpose.

The following figures illustrate the error of the asserted combination. Fig. 4 (from the patent to Tomita et al.) is the structure of the gas feed holes in the Tomita et al. apparatus. As described, the apparatus teaches and achieves prevention, or suppression, of polymer build-up in the gas feed holes through, among other factors, high mass flow rate through the gas feed holes, in desired pressure conditions.

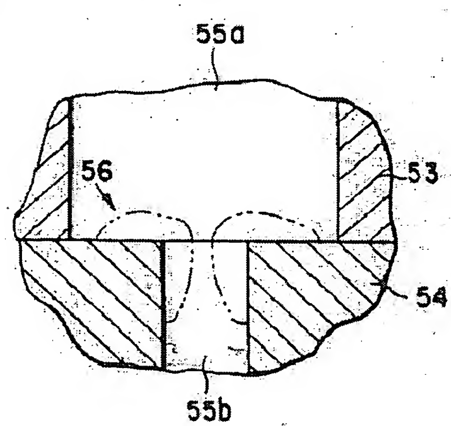

FIG. 4

Figures 2 and 3 (from the patent to Chang et al.) illustrate embodiments of the gas feed holes in the Chang et al. apparatus. To modify the Tomita et al. structure shown in Figure 4 according to the Chang et al. structures shown in Figs. 2 and 3, is

to fundamentally alter the Tomita et al. apparatus, rendering it unsuitable for its intended purpose.

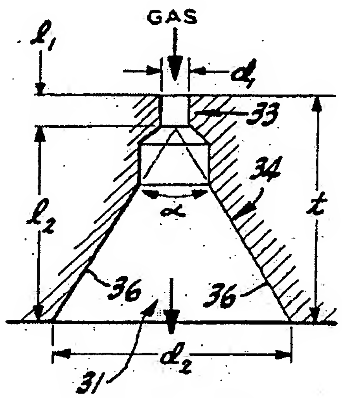

FIG-2

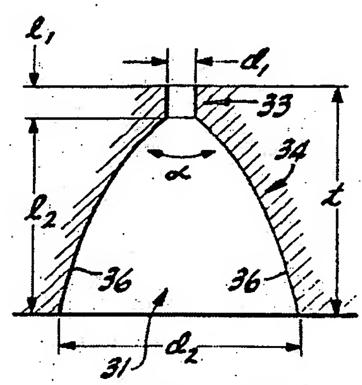

FIG-3

Examiner's secondary basis of rejection is that the size of the electrode openings in the Tomita et al. structure, in and of itself, will inherently enable the plasma sheath to shift into the electrode openings. Applicant further notes that the inherency quality is applied exclusively to the Tomita et al. reference, and ***not*** to the asserted combination, already addressed above. Applicants respectfully submit that the inherency assertion is simply not true. As recited in the MPEP at §2112, "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.'" Further, "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." The Tomita et al. apparatus is constructed in such a manner as to prevent plasma flow into the electrode openings, and Tomita et al. teach away from such plasma flow. Such plasma flow is ***undesirable*** in an apparatus as disclosed by Tomita et al.

In the Declaration Applicants have submitted in the instant application, Inventor Lumin Li asserts the following at paragraph 8:

> The objective of the reference patent is preventing polymer deposition. The size of the holes in the showerhead must be small enough to obtain the certain disclosed flow speed. At the same time, the flow speed must be maintained to prevent plasma light up inside the holes. A diameter of 0.6mm does not inherently shift the plasma sheath into the

> openings and create a surface area next to the electrode that is larger than the surface area that is next to the wafer. It is against common sense, basic plasma physics, and design rules for those skilled in the art -- that is, one of average competence and expertise in the field of plasma etch, would not modify the reference in such a manner as to increase size of the holes and purposely create plasma inside holes.

The Office has mistaken a minimum requirement of an electrode size to enable causing the plasma sheath to shift into the electrode openings, with an inherent characteristic. The size of the electrode opening alone is simply not a characteristic sufficient to cause the plasma sheath to shift into the electrode openings as claimed by Applicants.

For at least the above reasons, Applicants submit that independent claims 1, 5, 9, and 13 are patentable over Tomita et al. in view of Chang et al. under 35 USC §103(a). Dependent claims 2-4, 6-8, 10-12, and 14, each of which depends directly or indirectly from one of independent claims 1, 5, 9, and 13 are patentable for at least the same reasons. Applicants therefore submit that the rejection of claims 1-14 under 35 USC §103(a) as being unpatentable over Tomita et al. in view of Chang et al. is improper and should be withdrawn.

Respectfully submitted,
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APPENDIX A

CLAIMS ON APPEAL

1. An apparatus, comprising:

an electrode capable of being positioned over a substrate location, the electrode having a center region, a first surface and a second surface, the first surface being configured to receive processing gases and to enable flow of the processing gases through the center region, the second surface having a plurality of gas feed holes that are coupled to a corresponding plurality of electrode openings having electrode opening diameters that are greater than gas feed hole diameters of the plurality of gas feed holes, the plurality of electrode openings being configured to define the second surface which is located over the substrate location, the second surface having a surface area that is larger than a surface area of the substrate location, the larger surface area being capable of inducing an increased bias voltage at a point closer to the substrate location and a decreased bias voltage at a point closer to the second surface of the electrode when a plasma is struck in a space defined between the second surface and the substrate location.

2. The apparatus of claim 1, wherein a first plasma sheath surface is defined next to the substrate location and a second plasma sheath surface is defined next to the second surface, and the second plasma sheath surface follows an outline defined by the plurality of electrode openings of the second surface of the electrode.

3. The apparatus of claim 2, wherein the first plasma sheath surface has a first sheath surface area and the second plasma sheath surface has a second sheath

surface area, and the second sheath surface area is larger than the first sheath surface area.

4. The apparatus of claim 1, wherein each one of the plurality of electrode openings is at least about 0.5 mm or greater in diameter and each one of the plurality of gas feed holes has a diameter of about 0.1 mm.

5. An electrode, comprising:

an electrode body having a first surface and a second surface, the second surface having a plurality of gas feed holes that are coupled to a corresponding plurality of electrode openings, each electrode opening having an electrode opening diameter that is greater than a gas feed hole diameter of each of the plurality of gas feed holes, the second surface being defined by inner surfaces of the plurality of electrode openings so that a surface area of the second surface is larger than a surface area of the electrode body without the plurality of electrode openings, the larger second surface area being capable of inducing an increased bias voltage at a substrate processing surface.

6. The electrode of claim 5, wherein a plasma is defined between the second surface of the electrode and a substrate surface, the substrate surface being disposed adjacent to the second surface of the electrode, and with the second surface of the electrode, defining a processing space in which the plasma is defined.

7. The electrode of claim 6, wherein a plasma sheath having a first sheath surface and a second sheath surface is defined in the processing space, the first sheath

surface being defined next to the substrate surface and the second sheath surface being defined next to the second surface of the electrode, the second sheath surface following an outline defined by the plurality of electrode openings of the second surface of the electrode.

8. The electrode of claim 5, wherein each of the plurality of electrode openings is at least about 0.5 mm or greater in diameter and each of the plurality of gas feed holes has a diameter of about 0.1 mm.

9. An electrode, comprising:

an electrode body including,

a first surface; and

a second surface, the second surface having a plurality of gas feed holes, each one of the plurality of gas feed holes being integrally coupled to a corresponding electrode opening to comprise a plurality of electrode openings, each one of the plurality of electrode openings being larger than each one of the plurality of gas feed holes, the second surface defining a boundary of a plasma sheath, the plasma sheath having a first plasma sheath surface and a second plasma sheath surface, the second plasma sheath surface being at least partially within the plurality of electrode openings.

10. The electrode of claim 9, wherein the first plasma sheath surface is adjacent to a processing surface of a substrate, the first plasma sheath surface having a first plasma sheath surface area which is smaller than a second plasma sheath surface area of the second plasma sheath surface.

11. The electrode of claim 9, wherein when the second plasma sheath surface that is at least partially within the plurality of electrode openings causes an increase in bias voltage to be directed at an active surface of a substrate.

12. The electrode of claim 10, wherein the second plasma sheath surface area is about 2.7 times greater than the first plasma sheath surface area.

13. An electrode, comprising:

an electrode body having a process surface, the process surface having a plurality of gas feed holes, each gas feed hole being integrally coupled to a corresponding electrode opening, the electrode opening being larger than the gas feed hole, the process surface defining a plasma sheath having a surface that is at least partially within each electrode opening.

14. The electrode of claim 13, wherein each electrode opening is at least about 0.5 mm or greater in diameter and each gas feed hole has a diameter of about 0.1 mm, and wherein when a plasma is struck adjacent to the electrode, the plasma sheath shifts to be at least partially within each electrode opening.

APPENDIX B

EVIDENCE APPENDIX

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	09/611,037
Applicant:	:	Kuthi, et al.
Filed:	:	July 6, 2000
Title:	:	METHOD FOR IMPLEMENTING A SEMICONDUCTOR PROCESS CHAMBER ELECTRODE
TC/A.U.	:	1763
Examiner	:	Alejandro Mulero, L.
Atty. Docket No.	:	LAM1P077A

Declaration Under 37 CFR §1.132

I, Lumin Li, declare as follows:

1. I am a named inventor in the subject application. I earned an undergraduate degree in Electronic Engineering from Southeast University, and Ph.D. degree in Electrical Engineering from Colorado State University. I currently work in reactor design and process applications of plasma etcher, and have been employed for 11 years. For the past 8 years, I have been with Lam Research Corporation working on new dielectric etcher development.

2. I have reviewed the patent to Tomita et al. (U.S. Patent No. 5,593,540), the reference patent. The reference patent teaches how to prevent polymer deposition in the small holes of a showerhead electrode by high speed of gas flow. To achieve a mass flow speed of at least 620 $kg/m^2/hr$, the reference specifies the diameter of the holes in the showerhead must be smaller than 0.6 mm. The reference specifies 0.6 mm as the maximum diameter of the hole. Any hole larger than 0.6 mm will reduce gas speed and cannot prevent polymer deposition.

3. Our claimed invention described in the subject application is in the field of plasma physics. Our claimed invention teaches how to reduce sheath voltage next to the top electrode. By forming the plasma sheath inside the holes, the surface area of the plasma sheath next to the top electrode is increased, and its potential is reduced. The holes in the claimed invention must big enough to allow plasma to exist inside to form a hollow cathode discharge.

4. The diameter of the holes on the electrode showerhead is very critical for showerhead design. Increasing gas flow speed, and increasing the surface area of a plasma sheath are in different fields and have different technological focus. A large diameter of hole will reduce backside pressure, and will reduce gas flow speed through the holes. As a result, polymer may deposit inside holes. The reference patent specifies the maximum diameter of hole. Any hole larger than 0.6 mm will reduce gas speed and cannot prevent polymer deposition. On the contrary, hole size in our claimed invention must be bigger than a thickness of the plasma sheath to allow the sheath to form inside the hole. We specified the minimum hole size of 0.5 mm. The diameter of any hole larger than 0.5 mm will meet the requirement for a hole size, depending on various process parameters, including plasma sheath thickness.

5. Plasma sheath thickness depends on pressure, power and chemistry. For different etch applications, pressure in our etcher could vary from 10 mT to 2T, power could be 50W to 6KW, and there are more than 16 available gases. In order to include a wide range of plasma etch process regimes, we chose a diameter of 0.5 mm conservatively as the minimum size for the worst case with a high pressure, low power, and heavy polymer contents. For most of our applications, we prefer diameter of showerhead holes to be 2 ~ 10 mm.

6. Diameter of showerhead holes must be very small not only for gas flow speed, but also for preventing plasma light-up inside the hole. It is well known that when the hole is too large, and at high pressure, according to Paschen curve, plasma will ignite inside the hole. When plasma exists inside the hole, dense plasma inside of the hole will dissociate more species and generate more polymers inside the holes. As a result, there is or will be more polymer deposition. When plasma lights-up inside a hole, a sheath with high potential will accelerate ions and sputter away the electrode material. Plasma ignited inside a hole of showerhead is not desirable for a plasma etcher. The fast erosion of the electrode will quickly affect process repeatability, increase polymer deposition, and reduce lifetime of showerhead. It is a basic rule in plasma etcher design that the showerhead should prevent plasma light-up inside the hole. Our claimed invention purposely increases hole size and forms plasma in a portion of the hole, and is a

special case in which an increase in ion's energy on the wafer is critical for certain etch applications.

7. In our claimed invention, there are two different diameters of each hole specified for electrode showerhead design. The diameter of the hole in the top end and close to gas source (the gas feed holes) is 0.1 mm which is designed to prevent plasma from entering the holes and light-up inside of the holes and on a backside of the shower head. The diameter of the holes in the lower end and in contact with plasma (the electrode openings) is 0.5 mm which is designed to create plasma inside hole, increase the surface area of the plasma sheath next to the top electrode and increase the potential at the opposite electrode.

8. The objective of the reference patent is preventing polymer deposition. The size of the holes in the showerhead must be small enough to obtain the certain disclosed flow speed. At the same time, the flow speed must be maintained to prevent plasma light up inside the holes. A diameter of 0.6mm does not inherently shift the plasma sheath into the openings and create a surface area next to the electrode that is larger than the surface area that is next to the wafer. It is against common sense, basic plasma physics, and design rules for those skilled in the art -- that is, one of average competence and expertise in the field of plasma etch, would not modify the reference in such a manner as to increase size of the holes and purposely create plasma inside holes.

9. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

LUMIN LI

9-3-03
DATE

APPENDIX C

RELATED PROCEEDINGS APPENDIX

NOT APPLICABLE